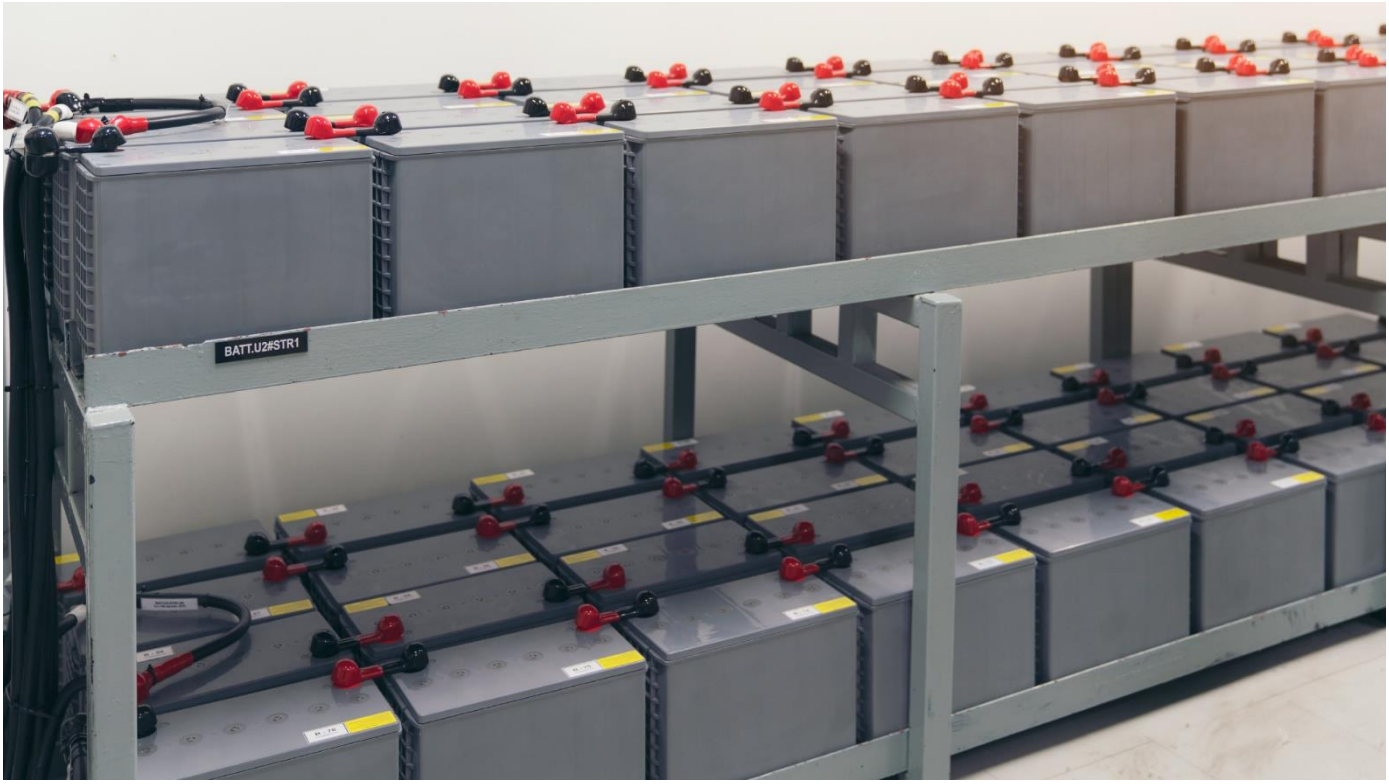

Growing Interest in Alternative Energy Storage to Benefit Flow Batteries

by Siddiqa Batool, *Research Analyst – at PTR Inc.*

- The most common types of flow batteries are vanadium redox batteries and zin bromide batteries.
- The battery flow technology is not widely deployed which is why there aren't many suppliers across the globe.
- Of all the suppliers available for this technology, majority of them are in North America and Asia Pacific.

The flow battery is an electrochemical device which has the capability to store several hundred megawatt-hours of energy, enough to meet the power requirements of thousands of homes for hours that too on a single charge. These batteries operate as a galvanic cell which harnesses the energy disparity between the chemical components that are dissolved in liquid electrolytes. These chemical components are separated with the help of membrane while the exchange of ions between the electrolytes which takes place through a membrane leads to generation of electric current. It is noteworthy that ion exchange is assisted by the membrane while the electrolytes do not cross over and circulate within their own specified chambers.

Although, a number of notable flow battery projects have been completed in recent years which include Dalian Energy Storage Project, Energy Superhub Oxford and Microgrid Project California there is not any significant activity in the market for flow batteries which is comparable to lithium-ion. But it is expected that the market will grow as the drawbacks of technology are catered. Regardless, due to supply chain constraints and cost issues linked with lithium, a shift in focus towards alternative energy storage technologies is observed which is a good omen for flow battery technology as well.

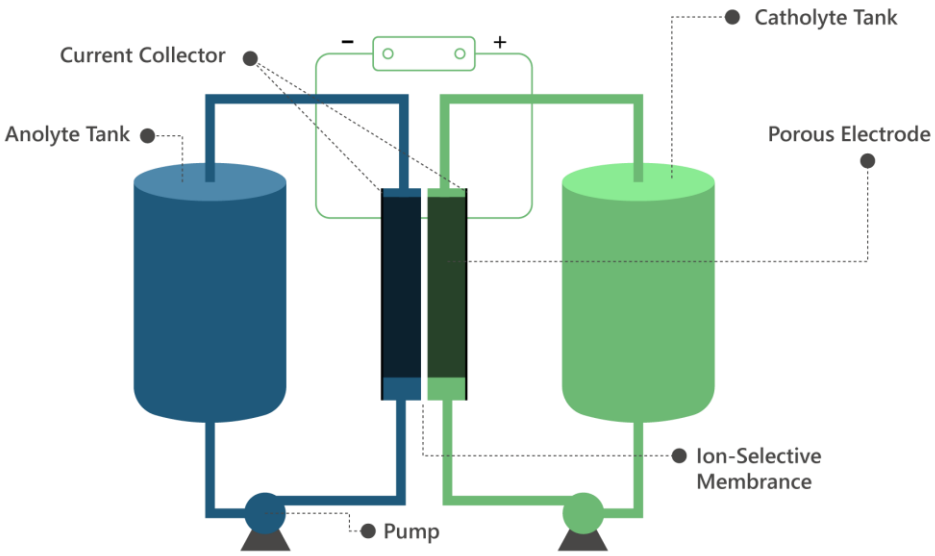

Figure 1: General mechanism of flow batteries.

Source: PTR Inc

Types of Flow Batteries

The most common types of flow batteries are vanadium redox batteries and zin bromide batteries. These flow battery types have their own pros and cons so a careful analysis of the technology can facilitate the deployment of technology in the industry that suits them the most.

Vanadium redox batteries

This battery technology consists of a rechargeable system which contains two electrolyte tanks, separated by an ion-exchange membrane. While charging and discharging, vanadium ions with distinct oxidation states are cycled between the tanks allowing the battery to store (during charging) and release (during discharging) electrical energy. These batteries have a range of advantages including absence of membrane crossover risk, stability and lack of requirement of catalyst for the redox reaction. However, this technology has challenges as well which need to be catered in case widespread deployment is desired including low energy and power density along with fluctuation in the price of electrolytes.

Zinc bromide batteries

Zin bromide battery is also referred to as hybrid redox flow battery as majority of the energy is stored via deposition of zinc metal on anode during the charging process. The solid zinc plating is responsible for energy capacity of the entire battery system which in turn depends on the size of the electrochemical stack (electrode area) and the capacity of reservoirs where electrolytes are stored. Therefore, the power and energy capacity of the zinc bromide flow battery rely on each other and is not completely independent. This battery technology has several benefits which include low electrolyte cost, high energy density of around 80Wh/kg and high voltage. On the other hand, disadvantages of this battery technology include poor lifetime of the battery system and high charging time.

Applications of Flow Batteries

In recent years, the use of lithium-ion batteries has increased radically for energy storage purposes but due to growing concerns about the cost of lithium and supply chain issues that emerged especially during the pandemic, interest in the alternative energy storage technologies for instance flow batteries is being developed. Flow batteries have a range of advantages due to which they are deemed fit for applications with specific requirements. For instance, their ability to store energy in liquid electrolytes which are segregated from the electrodes pave way for independent scaling of power and energy capacity in turn making them suitable for applications which require power output to sustain for longer duration. Similarly, there is reduced risk of thermal runaway due to separation of electrolytes which has made this technology suitable for applications which have heightened safety concerns.

Key Suppliers of Flow Batteries Across the Globe

The battery flow technology is not widely deployed which is why there aren't many suppliers across the globe. Of all the suppliers available for this technology, majority of them are in North America and Asia Pacific. With in North America majority of suppliers are in the US whereas in APAC, China has the highest number of suppliers of flow battery technology. As far as Europe is concerned it lags behind North America and APAC, with least number of suppliers of flow battery technology.

Figure 2: Suppliers of flow battery technology globally.

Source: PTR Inc

Looking Ahead

Flow battery technology has a range of advantages as compared to lithium-ion batteries for instance it is a long duration energy storage and is safe to use but there are some challenges as well which need to be addressed if greater deployment of this technology needs to be achieved. Major challenges include the concerns regarding the scalability of the battery due to low energy and power density followed by variations in the price of electrolyte. In order to deal with these challenges, investment in the research and development of flow batteries is required which will enable widespread deployment of flow batteries in the long run. The flow battery is certainly a promising alternative energy storage technology but very few projects have been installed all over the world so far and it is nowhere near becoming a rival to lithium-ion technology as of now.

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